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NASA Procedural Requirements

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COMPLIANCE IS MANDATORY

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Subject: Energy Efficiency and Water Conservation w/Change 1 (3/30/04)

Responsible Office: Environmental Management Division

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CHAPTER 4. Energy Auditing

4.1 The Energy Audit

4.1.1 The purpose of the energy audit is to identify energy-efficiency and cost-savings opportunities among building systems and equipment. The goal of the energy audit is to identify life-cycle, cost-effective energy conservation measures by evaluating the overall efficiency of building systems (HVAC, lighting, envelope) and the efficiency of individual components comprising those systems (pumps and motors, lamps and ballasts, windows). Energy audits shall be performed to the level of detail needed to identify, analyze, and document potential energy conservation measures. Although NASA facilities have been improved over the years by retrofits, many buildings, both old and new, still offer great energy- and cost-saving opportunities.

4.1.2 EO 13123 requires NASA to conduct or obtain comprehensive facility audits for all of its nonmission variable and energy-intensive facilities and to ensure that audits are completed for approximately 10 percent of these facilities each year. NASA shall also perform at least a walk-through level energy audit for all mission variable facilities over the same 10-year period.

4.2 Types of Audits

4.2.1 Walk-Through Energy Audits. A walk-through energy audit is a visual inspection of a facility made to determine operation and maintenance energy saving opportunities, as well as gather information to determine the need for a more detailed audit. The walk-through audit shall be arranged so that the audit team can see the major operational and equipment features of the facility. A walk-through audit usually begins with a review of a building's energy consumption over a prior period, usually the previous year. It is best for this information to be prepared in the form of an EUI, discussed in chapter 3.

4.2.1.1 Two types of information shall be recorded. First, identify and record what equipment and systems are installed, how the various equipment and systems interoperate and consume energy. Second, determine and record the evident conditions of the installed equipment and systems and, as appropriate, the energy conservation opportunities suggested by virtue of these existing conditions.

4.2.1.2 Walk-through energy audits are designed to identify only those deficiencies that are most obvious. Most substantial energy savings will be identified only through the more rigorous investigation of the comprehensive energy audit. Accordingly, walk-through audits are only appropriate for facilities under 10,000 gross square feet, for exempt facilities for which comprehensive audits would be too complex or costly, and as a means to prioritize facilities for conducting comprehensive audits. Typical concerns which may be covered by a walk-through audit include reduction of infiltration/exfiltration; quality of HVAC equipment O&M, including controls; lighting system energy efficiency opportunities; ventilation system operation, control, and opportunities for improvement; and tenant use practices.

4.2.2 Comprehensive Energy Audits. A comprehensive facility audit is defined as a survey of a building or facility that provides sufficiently detailed information to allow an agency to enter into energy or water-savings performance contracts or to invite inspection and bids by private upgrade specialists for direct agency-funded energy or water efficiency investments. The comprehensive facility audit shall include information such as the following:

a. The type, size, energy use, and performance of the major energy using systems and their interaction with the building envelope, the climate and weather influences, usage patterns, and related environmental concerns.

b. Appropriate energy and water conservation maintenance and operating procedures.

c. Recommendations for the acquisition and installation of energy conservation measures, including solar and other renewable energy and water conservation measures.

d. A strategy to implement the recommendations.

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4.9 Life-Cycle Costing

4.9.1 Life-cycle cost analysis is an integral part of the energy audit. Life-cycle cost analysis takes into account initial cost of the energy savings upgrade, energy costs and savings, operation and maintenance costs, component replacement costs, salvage value, and other factors that will affect cost over the entire life of the project. This will provide the necessary information to make a final decision on implementation of an energy savings measure.

4.9.2 To determine energy and demand savings, compare the energy and demand usage of the existing system with the roposed energy savings upgrade. Then perform a financial analysis that compares the cost of maintaining the existing system and the energy costs associated with the existing system to the cost of upgrading and maintaining the new system and the energy costs associated with the new system. The life-cycle cost analysis determines the net present value, savings to investment ratio, and internal rate of return of the investment. Typical acceptable life-cycle cost values are savings to investment ratio greater than one and an internal rate of return greater than 20 percent.

4.9.3 The Life-Cycle Costing (LCC) methods and procedures delineated in 10 CFR Part 436, Subpart A, must be followed, unless specifically exempted, in evaluating the cost-effectiveness of potential energy conservation and renewable energy investments in Federally-owned and leased buildings. LCC is the primary tool for analyzing energy retrofit projects. It considers all relevant costs. The data can be combined in the following ways to evaluate economic performance:

a. Total Life-Cycle Cost (TLCC). TLCC is the sum of all dollar costs of owning, operating, and maintaining a building or building system over the study period discounted to present value.

b. Net Life-Cycle Savings. This parameter is the decrease in TLCC cost attributable to an energy conservation project.

c. Savings-to-Investment (SIR) Ratio. The SIR is a numerical ratio comparing the projected reduction in energy costs (net of increased nonfuel operation and maintenance costs) to the estimated increase in investment cost, minus increased salvage values.

d. Simple Payback (SPB). The SPB is the elapsed time between the initial investment and the time at which cumulative savings in energy costs, net of other future costs, are just sufficient to offset the initial investment cost.

4.9.3.1 Each parameter has a different application. For example, the TLCC is best for choosing among alternative designs for a new building, whereas the SIR is best for ranking retrofit projects.

4.9.3.2 The National Institute of Standards and Technology (NIST) assists DOE in developing LCC methods and procedures. NIST Handbook 135, "Life-Cycle Costing Manual for the Federal Energy Management Program," is a valuable guide to understanding and applying LCC and related methods of economic analysis. Another NIST publication, "Energy Prices and Discount Factors for Life-Cycle Cost Analysis," provides an annual update of energy price and discount factor multipliers needed to estimate the present value of energy and other future costs. NIST also offers a computer program to calculate the life-cycle costs of capital investments in buildings and building systems that are intended to reduce future operating, maintenance, and energy costs. The Building Life-Cycle Cost (BLCC) computer program can be used to compute LCCs for different alternatives and compare alternatives for the lowest LCC or SIR. More information on the BLCC computer program is provided in Appendix C.

4.9.4 Economic Analysis for Discrete Projects in the CoF Program. An economic analysis is required to support each Program Direct and Mission Support discrete project in the CoF Program, including those involving energy-efficiency improvements. Economic analyses for discrete CoF projects must be prepared using the ECONPACK software package developed by the U.S. Army Engineering and Support Center, Huntsville, Alabama. ECONPACK is a comprehensive economic analysis tool containing standardized life-cycle methodologies and calculations for evaluating a broad range of capital investments. The package also provides a straightforward methodology for including the cost of cost of doing nothing, which must be included in all analyses to provide a common footing for establishing the economic value of construction projects and the construction program as a whole. The ECONPACK software package uses the prescribed procedures defined in OMB Circular A-94. Appendix C contains information on how to obtain the ECONPACK software.

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